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S&S® Replacement Engine Owner's Manual

DISCLAIMER:
S&S parts are designed for high performance, closed course, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely effect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

The words Harley®, Harley-Davidson®, H-D®, Sportster®, Evolution®, and all H-D part numbers and model designations are used in reference only. S&S Cycle is not associated with Harley-Davidson, Inc.

SAFE INSTALLATION AND OPERATION RULES:
Before installing your new S&S part it is your responsibility to read and follow the installation and maintenance procedures in these instructions and follow the basic rules below for your personal safety.

- Gasoline is extremely flammable and explosive under certain conditions and toxic when breathed. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.
- If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.
- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with an S&S part on it.
- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.
- Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

IMPORTANT NOTICE:

Statements in this instruction sheet preceded by the following words are of special significance.

⚠ WARNING

Means there is the possibility of injury to yourself or others.

⚠ CAUTION

Means there is the possibility of damage to the part or motorcycle.

NOTE

Other information of particular importance has been placed in italic type.

S&S recommends you take special notice of these items.

WARRANTY:
All S&S parts are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of twelve (12) months from the date of purchase. Merchandise that fails to conform to these conditions will be repaired or replaced at S&S's option if the parts are returned to us by the purchaser within the 12 month warranty period or within 10 days thereafter.
In the event warranty service is required, the original purchaser must call or write S&S immediately with the problem. Some problems can be rectified by a telephone call and need no further course of action.
A part that is suspect of being defective must not be replaced by a Dealer without prior authorization from S&S. If it is deemed necessary for S&S to make an evaluation to determine whether the part was defective, a return authorization number must be obtained from S&S. The parts must be packaged properly so as to not cause further damage and be returned prepaid to S&S with a copy of the original invoice of purchase and a detailed letter outlining the nature of the problem, how the part was used and the circumstances at the time of failure. If after an evaluation has been made by S&S and the part was found to be defective, repair, replacement or refund will be granted.

ADDITIONAL WARRANTY PROVISIONS:
(1) S&S shall have no obligation in the event an S&S part is modified by any other person or organization.
(2) S&S shall have no obligation if an S&S part becomes defective in whole or in part as a result of improper installation, improper maintenance, improper use, abnormal operation, or any other misuse or mistreatment of the S&S part.
(3) S&S shall not be liable for any consequential or incidental damages resulting from the failure of an S&S part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or for any other breach of contract or duty between S&S and a customer.
(4) S&S parts are designed exclusively for use in Harley-Davidson® and other American v-twin motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.

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Congratulations on purchasing an S&S® engine! Your new engine is designed and manufactured with the same care and attention to detail as those used to set speed records and win races around the world.

This manual has been prepared to acquaint you with the operation, care, and required maintenance of your engine. It also notifies you of important safety information and provides authorized service personnel with necessary emissions control specifications. Other S&S publications discuss repairs and/or changes to the engine configuration. For information related to other components and systems on the motorcycle consult the manufacturer's manuals.

S&S Replacement Engines are legal for use in all 50-States as replacement engines in 1970-1998 Harley-Davidson® motorcycles originally equipped with a carbureted, non-catalyst, big twin engine.

Per the tampering and defeat device prohibitions, under the Clean Air Act and California State law, it is illegal to remove or render inoperative any device or element of an emissions control system, or to install any part or component that would bypass, defeat, or render inoperative any device or element of design installed on the vehicle under the Clean Air Act or California State law regulations. This includes but is not limited to any changes made to camshafts, fuel metering system, ignition, exhaust system or evaporative system.

ENGINE IDENTIFICATION NUMBER

The Engine Identification Number (EIN) is stamped on the left side of the crankcase below the front cylinder deck, and on the right side immediately forward of the front tappet guide. It consists of a seven-character code (see example below). The first and last characters are stars (*). The second character is a letter that designates the code for the model year of the engine. The final four characters before the star are the crankcase serial/sequence number for that year. Some serial numbers will contain an eighth character between the year code and serial number.
Example: *G1234* represents crankcase sequence number 1234 that it was made in 2006.

Year Code	
2005	F
2006	G
2007	H
2008	J
2009	K
2010	L

CONTROLS AND GAUGES

The starter, key switch, engine-stop switch, throttle control grip, tachometer (if available), speedometer, oil pressure gauge, voltmeter, and fuel gauge are discussed in detail in the motorcycle owner's manual.

Enrichment Device

The carburetor uses a mixture enrichment device instead of a choke, but it is operated in a similar manner. During starting and operation before the engine is warmed up, the lever located on the upper side of the air cleaner should be pulled up. When the engine is sufficiently warm, as described in the OPERATION section, the enrichment device lever is pushed down.

Petcock

The petcock is located under the fuel tank as described in the motorcycle owner's manual. On some motorcycles, the petcock operates automatically; on others, manual operation is required.

⚠ WARNING

Motorcycles with manual-operated petcock: petcock should always be closed when engine is not running to prevent accidental overflow of gasoline and possible fire hazard or damage to engine.

Further information about the petcock may be found in the motorcycle owner's manual.

OPERATION

Engine Speed and Load

⚠ CAUTION

Exceeding 6,250 RPM under any circumstances may damage the engine.

An engine that is run long distances at high speed or under heavy load may overheat. Oil and spark plugs should be inspected more frequently when the engine is subjected to extreme temperatures.

Idle Speed

⚠ CAUTION

Do not idle engine more than five minutes with motorcycle stationary. Overheating may result.

Normal warm idle speed is 1,050 RPM. When the enrichment device lever is pulled up with a cold engine, the idle will be higher.

Oil Pressure
Engine oil pressure varies from 5 psi (.34 bar) at idle to 12-15 psi (.83-1 bar) at 50 mph (80 km/h) when the engine is at normal operating temperature.

Altitude
The engine should operate correctly between sea level and 3,000 feet without further adjustment. For operation above 3,000 feet see your authorized S&S dealer for proper carburetor adjustments.

Engine Break-In
During the first 500 miles of operation, critical parts are "breaking-in" against each other. For this reason:
1- Avoid excessive heat build-up. Do not allow engine to idle for long periods of time.
2- Keep the outside of the engine clean.
3- Do not subject engine to unusual stress or load as with sidecar or trailer.
4- Avoid hard acceleration until the engine is warmed up.
5- Do not lug the engine. Vary the engine speed; avoid maintaining a steady speed for long distances.

First 50 Miles (80 Kilometers) –
1- Without lugging the motor, do not exceed 50 mph (80 km/h).
2- Keep the engine speed below 2,500 RPM.
3- Change the oil and filter at 50 miles (80 kilometers).

Up to 500 Miles (800 Kilometers) –
1- Do not exceed 65 mph (105 km/h).
2- Keep the engine speed below 3,000 RPM.
3- Change the oil and filter at 500 miles (800 kilometers).

Up to 2,500 Miles (4000 Kilometers) –
1- Keep the engine speed below 3,500 RPM.

For motorcycles not equipped with tachometers, the following table may be used as a guide for estimating the engine RPM in each gear based on the road speed.

Road Speed At 2,000 & 3,000 RPM In Each Gear Based On Stock Late-Model Harley-Davidson® FL and FX Overall Gear Ratios and Rear Tire Size		
Gear	**Road Speed at 2,000 RPM**	**Road Speed at 3,000 RPM**
1st	15 mph (24 km/h)	22 mph (35 km/h)
2nd	22 mph (35 km/h)	32 mph (52 km/h)
3rd	30 mph (48 km/h)	44 mph (71 km/h)
4th	39 mph (63 km/h)	58 mph (93 km/h)
5th	47 mph (75 km/h)	71 mph (114 km/h)

Pre-ride Checklist
Before riding, or with each tank of gas, confirm that your motorcycle is in good operating condition. The motorcycle owner's manual has specific information regarding this subject.

To ensure safe, reliable engine operation:
1- Check oil level in oil tank.
2- Check for oil and fuel leaks.

Starting and Warm-Up
General:
1- Before starting engine, shift transmission into neutral.
2- Never allow engine to exceed 2,500 RPM immediately after cold start. Engine should be run slowly for 15 to 30 seconds. This allows engine to warm up, and oil to reach all surfaces requiring lubrication.
3- Idling with enrichment device lever in full-out position for longer than 30 seconds is not recommended. Lever may be set in intermediate position if engine will not run smoothly with it pushed all the way in.
4- Use oil meeting recommendations found in maintenance section of this owner's manual for expected ambient temperature range and type of operation.

Cool Engine:
1- Open petcock if it is manual type.
2- Pull enrichment device lever to raised position.
3- Twist throttle one or two times.
4- Close throttle.
5- Turn Key to IGNITION.
6- Turn Engine-Stop Switch to RUN.
7- Press Start Switch.
8- After engine starts, adjust enrichment lever depending on ambient temperature:
   a- Below 70°F (21°C) - Push enrichment lever in as engine warms. If idle becomes slow or rough, pull lever up slightly. Enrichment lever should be pushed in completely after not more than 60 seconds of operation.
   b- 70°F (21°C) or Warmer - Push enrichment lever completely in after 10 to 30 seconds of operation.

Warm or Hot Engine:
1- Open petcock if it is manual type.
2- Pull enrichment lever to fully raised position.
3- Turn Key to IGNITION.
4- Turn Engine-Stop Switch to RUN.
5- Press Start Switch.
6- After engine starts, immediately push enrichment lever completely in.

Gear Speed Changes
For normal riding, the recommended shift points to higher gears while accelerating are shown on the following page. Note, for best fuel economy, use the smaller numbers in each speed range.

Recommended Acceleration Shift Points		
Gear Change	**Engine RPM**	**Approximate Road Speed 1***
1st to 2nd	1,800 to 2,400	13 to 17 mph (21 to 27 km/h)
2nd to 3rd	2,000 to 2,300	20 to 24 mph (32 to 39 km/h)
3rd to 4th	1,900 to 2,300	28 to 34 mph (45 to 55 km/h)
4th to 5th	2,100 to 2,300	39 to 43 mph (63 to 89 km/h)
* Based on a N/V ratio of 43.3		

For normal riding, the recommended shifting procedure to lower gears while decelerating is:
1- Disengage clutch.
2- As motorcycle slows, shift into appropriate gear for beginning next mode of operation.
3- When slowing to a stop, the clutch should be disengaged when:
   a- The motorcycle speed drops below approximately 15 mph (24 km/h).
   b- Rough engine operation is evident.
   c- When the engine is lugging.

The motorcycle should be shifted into neutral if it is going to be shut off or kept at an idle for more than a few seconds.

MAINTENANCE

To maintain your new engine warranty and to assure proper emissions system operation, regular inspections and servicing must be performed.

Periodic

The motorcycle should be checked frequently (for example, with each tank of gasoline) for fuel or oil leaks and oil level. After the engine is warm, the idle speed may occasionally require minor adjustment. The air cleaner should be inspected every few hundred miles. See the motorcycle owner's manual for other recommended periodic maintenance.

During Break-In

At 50 Miles (80 Kilometers):

1- Change engine oil and filter.
2- Inspect for fuel and oil leaks.
3- Inspect air cleaner element and service as required.
4- Check tightness of exterior fasteners, except head bolts.

Engine Maintenance at 500 Miles (800 Kilometers):

1- Change engine oil and filter.
2- Inspect for fuel and oil leaks.
3- Inspect air cleaner element and service as required.
4- Check tightness of exterior fasteners, except head bolts.
5- Check operation of enrichment device and throttle controls.
6- Check engine idle speed.
7- Check tightness of engine mounts.

Regular Service Intervals

Regular lubrication and maintenance will help keep your new S&S engine operating at peak performance. The following table presents the required service schedule for normal operating conditions. Failure to complete the required engine maintenance can result in engine damage and an increase in emissions. Please refer to the motorcycle owner's manual for any additional required chassis maintenance.

Engine Service Intervals	
Item	**Interval**
Engine Oil & Filter	Change at 50, 500, 2,500 miles (80, 800, 4,000 kilometers), every 2,500 miles (4,000 kilometers) thereafter[1].
Air Cleaner Element	Inspect at 50 and 500 miles (80 and 800 kilometers), every 2,500 miles (4,000 kilometers) thereafter[2]. Replace every 5,000 miles (8,000 kilometers).
Tappet Oil Screen	Inspect every 2,500 miles (4,000 kilometers). Replace every 5,000 miles (8,000 kilometers).
Petcock, Lines, & Fittings, Vacuum Lines	Inspect at 50 and 500 miles (80 and 800 kilometers), every 2,500 miles (4,000 kilometers) thereafter.
Fuel Tank Filter Screen & In-Line Fuel Filter (If used)	Inspect every 5,000 miles (8,000 kilometers).
Engine Idle Speed	Adjust as required.
Operation of Throttle & Enrichment Device Controls	Inspect at 500 miles (800 kilometers) and every 2,500 miles (4,000 kilometers) thereafter.
Spark Plugs	Inspect every 5,000 miles (8,000 kilometers). Replace every 10,000 miles (16,000 kilometers) or as needed.
Ignition Timing	Inspect every 5,000 miles (8,000 kilometers).
Engine Mounts	Inspect at 500 miles (800 kilometers) and every 5,000 miles (8,000 kilometers) thereafter.
External Fasteners Except Engine Head Bolts	Re-torque at 500 miles (800 kilometers) and every 5,000 miles (8,000 kilometers) thereafter.
1- S&S recommends that petroleum-based oil not specifically formulated for motorcycles should be changed every 1,000 miles (1,600 kilometers) after the break-in period. 2- Replace more frequently if required or if engine is operated in a dusty environment.	

⚠ CAUTION

Motorcycles operated under adverse conditions (severe cold, heat, dusty or wet conditions, extended idling, pro-longed high speed, or extreme load) should have regular maintenance performed more frequently to ensure safe, reliable operation.

Engine Oil
Engine oil is a major factor in the performance and service life of the engine. Use the proper viscosity of oil for the ambient temperature range anticipated before the next oil change as shown in the following table.

Recommended Engine Oils	
Ambient Temperature Range	**Viscosity Grade**
Below 40°F (4°C) (Winter Only)	SAE 10W40
40°F (4°C) to 100°F (38°C)	SAE 15W50 or 20W50
50°F (10°C) to Above 100°F (38°C)	SAE 25W60
60°F (16°C) to 100°F (38°C)	SAE 50
80°F (27°C) to Above 100°F (38°C)	SAE 60
Notes: • Use only API SG or SH rated oil. • S&S recommends regular oil changes every 1,000 miles (1600 kilometers) when using petroleum-based oil not specifically formulated for motorcycles.	

NOTE: *S&S® recommends using Mobil 1 V-Twin synthetic oil. S&S recommends regular oil changes every 1,000 miles (1,600 kilometers) when using petroleum-based oil not specifically formulated for motorcycles.*

Checking, Adding & Changing Engine Oil
See the motorcycle owner's manual for information on how to check, add, and change the oil and filter.

Hydraulic Lifter Oil Filter Screen
The access screw for this screen is located on the right side of the crankcase, beside the rear tappet block. Carefully remove the screw to expose the spring and filter screen. Remove the spring and filter screen from the crankcase. Clean or replace the screen. Reinstall the screen (open end down), spring, and screw.

Gas Tank Fuel Stainer & In-Line
Inspect and clean the gas tank fuel strainer according to the motorcycle owner's manual. If an in-line filter is used (recommended), it should be replaced or cleaned according to manufacturer's specifications.

Carburetor
The carburetor has been specifically set up for emissions control. All jets are fixed at the factory.

Idle Speed Adjustment
1- Operate motorcycle until engine is warmed up (typically 15 minutes).
2- The idle speed adjustment screw is located on top of the carburetor just under the throttle cable guide. Use a long, blade-type screwdriver to adjust the idle speed to 1,050 RPM.

Air Cleaner Element
The air cleaner element is a special carbon impregnated element designed to reduce the amount of fuel vapor from escaping the carburetor. The element should be replaced every 5,000 miles. It is designed to be run dry; i.e., without oil.

NOTE: *Oiling filter will cause improper engine operation.*

If the carbon filter element is torn, punctured or has excessive build-up, replace the assembly.

⚠ CAUTION

A damaged, torn, or crushed element may release carbon into the engine resulting in severe engine damage. In the event of a damaged air filter- replace filter immediately.

Replacement:
1- Remove air cleaner cover and filter element from backplate.
2- Install new carbon element on air cleaner backplate by stretching the smaller diameter around the hub of the backplate. It should be a tight fit. If not, turn it around.
3- Reinstall air cleaner cover. S&S recommends applying Blue Loctite® to the three Phillips oval head screws. Tighten screws until they bottom out.

Hydraulic Lifters
Hydraulic lifters are self-adjusting. They automatically adjust length to compensate for engine expansion and valve train wear, keeping the valve train free of lash while the engine is running. When starting the engine, the valve train may be noisy until the lifters refill with oil. If the valve train remains noisy after twenty minutes of operation, this may be an indication that one or more of the lifters is not functioning properly. Remove and clean the hydraulic lifter oil filter screen. Consult an S&S service agent if further service is required.

Spark Plugs
Spark Plug Removal:
1- Disconnect spark plug wires from spark plugs by pulling on the molded connector boots. It may help to twist or rock the boots back and forth slightly while pulling.
2- Unscrew spark plugs.

Spark Plug Inspection:
If either of the following conditions occurs, further service is required.
1- A spark plug with a black, glossy-wet coating indicates that oil is entering the combustion chamber.
2- A spark plug that is wet with gasoline or has sooty deposits indicates either a faulty ignition or a problem with carburetion.

Spark Plug Installation:
Spark plugs must be screwed in correctly to avoid cross-threading, and tightened adequately to ensure proper heat transfer. Do not over-tighten.

⚠ CAUTION

Threads may strip in the aluminum cylinder heads if over-tightened. Repair will not be covered under warranty.

1- Inspect spark plug threads and clean if necessary.
2- Set plug gap 0.040"to 0.045."
3- Apply anti-seize to threads of spark plugs.
4- Start screwing spark plugs in by hand. They should screw in easily.
5- Torque spark plugs to 18 to 22 lb-ft (24 to 30 N-m).

Ignition Timing
Timing advances electronically as the engine speed changes.

Ignition Timing Check:
1- With engine not running, connect inductive timing light to front spark plug wire.
2- Loosen timing plug from left side of crankcase where two cylinders meet.

⚠ WARNING

Oil mist will exit timing plug hole when engine is running. It is recommended that a transparent inspection plug (not provided) be installed prior to starting engine to prevent discomfort and possible injury to eyes.

3- Start engine and reach normal operating temperature. Set engine speed to RPM given in engine specifications.

NOTE: *An inductive tachometer, attached to spark plug cable, may be helpful if the motorcycle is not equipped with a tachometer. Tachometers designed for "wasted spark" ignition systems may read half the actual engine speed.*

4- Using dial-back timing light, set the amount of advance specified, found in the engine specifications or on the emission tune-up label for the engine.
5- Illuminate flywheel inside crankcase through transparent timing plug with timing light. The "T:F" mark stamped on the flywheel should be centered in the plug.
6- Stop engine, remove transparent timing plug and replace metal one supplied with engine.

Ignition Timing Adjustment

⚠ CAUTION

TO BE PERFORMED ONLY BY AN AUTHORIZED SERVICE AGENT. Ignition timing is not to be adjusted. Contact your authorized S&S® dealer if service is required.

NOTE: *Engines with Super Stock® ignition come timed from the factory and have a tamper proof seal. Breaking this seal will void the engine warranty.*

Storage

If the motorcycle will be stored for several months, the carburetor float bowl should be drained to avoid a buildup of gum or varnish. The following procedure should be used:

1- Fully close the petcock.
2- Place small, open container below float bowl.
3- Unscrew drain plug to allow gasoline to drain into container.

⚠ WARNING

Gasoline is extremely flammable and vapors can be toxic or explosive. Adequate ventilation must be provided and sparks or open flame avoided when working with gasoline.

4- Reinstall and tighten drain plug.

Engine Specifications

Slow Idle Speed: 1050 RPM with engine warm
Ignition Timing: 20 deg BTDC @ 2,000 RPM
Idle Mixture: < 2.0% CO Warm Idle
Spark Plug: 4265 or Equivalent
Spark Plug Gap: 0.040"-0.045"
Fuel: Unleaded Gasoline Only, 91 R+M/2 Octane
Oil: Refer to Engine Oil section in this manual.